

## Computer Technology Opportunities in Hawaii

While there has been talk of Hawaii's "brain drain," people leaving the islands for better paying jobs on the mainland USA, it is not due to a lack of computer job opportunities in the state. Among the top ten fastest growing occupations in the state can be found four occupations that are hi-tech oriented or computer-related. These are: **computer support specialists, computer systems analysts, computer engineers, and computer and information systems managers.**

Additionally, **computer programmers**, although not among the fastest growing occupations, are one of the largest groups in this field and should be considered another ample source of jobs.

### What do they do?

**Computer support specialists** provide technical assistance to computer system users. They answer questions or resolve computer problems for clients in person, via telephone or from remote location. They may provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems.

**Computer programmers** convert project specifications and statements of problems and procedures to detailed logical flow charts for coding into computer language. They develop and write computer programs to store, locate, and retrieve specific documents, data, and information, and may also program web sites.

**Computer system analysts** analyze science, engineering, business, and all other data processing problems for application to electronic data processing systems. They may analyze user requirements, procedures, and problems to automate or improve existing systems and review computer system capabilities, workflow, and scheduling limitations. They may analyze or recommend commercially available software, and may also supervise computer programmers.

**Computer engineers** can be further sub-divided into three types: **applications software engineers, systems software engineers, and hardware engineers.**

- **Applications software engineers** develop, create, and modify general computer applications software or specialized utility programs. They analyze user needs and develop software solutions, design software or customize software for client use with the aim of optimizing operational efficiency. They may analyze and design databases within an application area, working individually or coordinating database development as part of a team.
- **Systems software engineers** research, design, develop, and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, and general computing applications. They set operational specifications and formulate and analyze software requirements as well as apply principles and techniques of computer science, engineering, and mathematical analysis.
- **Hardware engineers** research, design, develop, and test computer or computer-related equipment for commercial, industrial, military, or scientific use. They may supervise the manufacturing and installation of computer or computer-related equipment and components.

**Computer and information systems managers** plan, direct, or coordinate activities in such fields as electronic data processing, information systems, systems analysis, and computer programming.

## **Where are the jobs?**

In 1998, overwhelmingly, the computer-related jobs of engineers (67 percent), programmers (57 percent), support specialists (55 percent), and information system managers (45 percent) were found in the services industry. A large percentage of computer systems analysts (24 percent) were also in that industry, although the largest share (55 percent) was in government. The finance, insurance, and real estate sector and transportation, communication, and utilities sector employed a lot of these types of jobs, too.

## **What kind of compensation can they expect?**

According to a 2000 statewide wage survey, computer programmers earned an average hourly wage of \$20.84 or annually \$43,355. Computer support specialists on average brought in more at \$23.69 an hour or \$49,284 a year. Computer systems analysts averaged \$25.85 hourly, amounting to \$53,760 annually. Meanwhile, systems software engineers and applications software engineers earned \$27.39 and \$29.20 an hour or \$56,978 and \$60,746 a year, respectively. Hardware engineers earnings did even better, averaging \$34.48 hourly or \$71,711 annually. At the managerial level, computer and information systems managers took home \$32.53 an hour or \$67,653 a year.

## **How many jobs?**

In 2000, the total statewide employment for these kinds of computer-oriented jobs was 4,970. The following is the breakdown by specific occupation:

Computer support specialists	1,580
Computer systems analysts	1,330
Computer programmers	650
Computer software engineers, applications	280
Computer software engineers, systems software	300
Computer hardware engineers	10
Computer and information systems managers	820

## **What will be the demand and how much growth is expected?**

Employment for these specific computer jobs is anticipated to increase by approximately 3,020 between 1998 and 2008. This will mean a significant gain of over 59 percent as compared to the 13 percent gain for all occupations. On an annual basis, the increase will account for about 380 jobs yearly over the ten year period. Unlike a lot of occupations, almost all of the annual job openings or 82 percent will be attributable to job growth rather than occurring as a result of persons separating from or replacing others in previously established positions.

Although the number of computer engineers is next to the smallest of the selected occupations, that occupation is expected to increase the fastest, almost doubling its count over ten years. Computer support specialists and computer system analysts, both large in numbers, will also make big strides, expanding by 90 and 66 percent, respectively. While the engineering, natural science, computer, and information system managers group registered a modest count, its growth will also be quite impressive, advancing by 47 percent. The 17 percent expansion of the smallest group, computer programmers, is mild in comparison to the rest of the computer-related field, but the rate should still outpace the 13 percent rate for all occupations.

<b>Projected Employment Growth &amp; Job Openings for Selected Computer Occupations State of Hawaii 1998-2008</b>					
<b>Occupation</b>	<b>Projected</b>		<b>Average Annual Job Openings</b>		
	<b>Employment Growth</b>		<b>Due to</b>		<b>Total</b>
	<b>Number</b>	<b>Percent</b>	<b>Growth</b>	<b>Separations</b>	
Engr/Nat Sci/Comp/Info Sys Managers	400	47.1	40	20	60
Computer Engineers	310	96.9	30	*	30
Computer Systems Analysts	1,190	66.1	120	10	130
Computer Programmers	180	16.8	20	30	50
Computer Support Specialists	940	90.4	100	10	110
<b>Total</b>	<b>3,020</b>	<b>59.4</b>	<b>310</b>	<b>70</b>	<b>380</b>
* Number is greater than zero and less than ten.					

### Who are prepared and qualified to fill the jobs?

In 2000, persons who completed training in computer and information science numbered 90, those with computer programming-based education accounted for 53, others who had studied management information systems and business data processing amounted to 119, and a few others, who acquired data processing skills, contributed to the mix. In total, over 260 persons had acquired some computer knowledge. However, that will not be sufficient to keep up with the demand mentioned in the previous section for approximately 380 positions a year.

### How can you prepare for these jobs?

All four of these kinds of computer occupations require at least vocational training, related on-the-job experience, or an associate's degree. Most require a bachelor's degree, and some require even more.

Programs in Computer and Information Sciences offer the necessary background for computer related jobs. Students study a variety of topics including software principles used to design structured computer programs. Program lengths vary. Community colleges may offer the first two years of degree requirements that may be transferred to a four year college for degree completion. Course work may include all or some of the following:

Algorithm Analysis	Computer Graphics
Data Communications	Data Structures
Introduction to Computer Sciences	Logic Design
Microprocessors	Multimedia
Networking	Operating Systems
Programming Language Theory	Software Engineering
System Analysis and Design	

Four-year and community college programs usually include courses in related academic areas such as mathematics, probability and statistics, accounting, physics, and chemistry as well as general education requirements such as English composition and communications.

Data Processing programs prepare persons to operate computers and related equipment. Program lengths vary and some programs may include general clerical courses. Programs may include all or some of the following:

Accounting  
Business Machines  
Communications  
Networking  
Typing/Keyboarding

Business English  
Business Mathematics  
Data Processing  
Programming Languages  
Word Processing

Instruction generally consists of class lectures and considerable laboratory work with computers.

Although there are no state regulations regarding these professions, professional designation is available from the Institute for Certification of Computer Professionals (ICCP). The professional designation requires passing exams, meeting experience requirements, and complying with the ICCP codes of ethics, conduct, and good practice. Some manufacturers offer certification to persons who have demonstrated knowledge of a particular network operating system.

### What are some other qualifications needed for these jobs?

In addition to formalized preparation, other important assets to have that will help in securing and retaining computer oriented jobs can be divided into three areas: **skills, knowledge, and abilities**.

**Skills Considered Important for Selected Computer Occupations**  
(Grouped by Frequency and Ranked by Order of Importance Within Each Group)

Skills	Support Specialist	Programmer	Systems Analyst	Engineer	Manager	Rank Avg.
<b>Problem Identification</b> -Identifying the nature of problems	5	7	6	10	1	5.8
<b>Troubleshooting</b> -Determining what is causing an operating error and deciding what to do about it	2	10	2	5		4.8
<b>Reading Comprehension</b> -Understanding written sentences and paragraphs in work related documents	6	3	3		8	5.0
<b>Information Gathering</b> -Knowing how to find information and identifying essential information	7		9	7	10	8.3
<b>Programming</b> -Writing computer programs for various purposes		1	1	4		2.0
<b>Operations Analysis</b> -Analyzing needs and product requirements to create a design	4		5	1		3.3
<b>Testing</b> -Conducting tests to determine whether equipment, software, or procedures are operating as expected	3	6	4			4.3
<b>Writing</b> -Communicating effectively with others in writing as indicated by the needs of the audience		2	7		5	4.7
<b>Active Learning</b> -Listening to what other people are saying and asking questions as appropriate		8		8	6	7.3
<b>Active Listening</b> -Working with new material or information to grasp its implications	9	9	8			8.7
<b>Information Organization</b> -Finding ways to structure or classify multiple pieces of information		5		3		4.0
<b>Critical Thinking</b> -Using logic and analysis to identify the strengths and weaknesses of different approaches	8	4				6.0
<b>Implementation Planning</b> -Developing approaches for implementing an idea			10		4	7.0
<b>Speaking</b> -Talking to others to effectively convey information				9	7	8.0

\*Rank ranges from 1 to 10 with 1 = Highest

One of the *skills* that appeared necessary for people specializing in all of the specified computer occupations is *problem identification*, where they are able to identify the nature of problems. *Troubleshooting*, which is determining what is causing an operating error and deciding what to do about it, is crucial for everyone but managers. *Reading comprehension* and *information gathering*, which is knowing how to find and select essential information, are also very important and required of 4 out of 5 of these occupations. Naturally, *programming*, *operations analysis*, which is analyzing needs and product requirements, *testing*, and *active listening* are cited as skills necessary for those nonmanagerial, while *writing* and *active learning* were critical for managers. Some other skills found common among two out of five computer type jobs are: *information organization*, which is finding ways to structure or classify multiple pieces of information, *critical thinking*, *implementation planning* (developing approaches for implementing an idea), and *speaking*, the latter two being more important for managers. Individually, support specialists need to also possess the following: *instructing* and *equipment selection*. Engineers should be prepared with *mathematics* and *science* and computer managers should also have *coordination*, *judgement and decision making* skills, and be able to *manage personnel*.

### Knowledge Considered Important for Selected Computer Occupations (Grouped by Frequency and Ranked by Order of Importance Within Each Group)

Knowledge	Support Specialist	Programmer	Systems Analyst	Engineer	Manager	Rank Avg.*
<b>Computers &amp; Electronics</b> -Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming	1	1	1	1	2	1.2
<b>Education &amp; Training</b> -Knowledge of instructional methods and training techniques including curriculum design principles, learning theory, group and individual teaching techniques, design of individual development plans, and test design principles	2	4	3	5	6	4.0
<b>Mathematics</b> -Knowledge of numbers, their operations, and inter-relationships including arithmetic, algebra, geometry, calculus, statistics, and their applications		2	4	3	3	3.0
<b>English Language</b> -Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar		3	2	4	4	3.3
<b>Clerical</b> -Knowledge of administrative and clerical procedures and systems such as word processing systems, filing and records management systems, stenography and transcription, forms design principles, and other office procedures and terminology		5		8	9	7.3
<b>Customer &amp; Personal Service</b> -Knowledge of principles and processes for providing customer and personal services including needs assessment techniques, quality service standards, alternative delivery systems, and customer satisfaction evaluation techniques			5	10	8	7.7
<b>Administration &amp; Management</b> -Knowledge of principles and processes involved in business and organizational planning, coordination, and execution. This includes strategic planning, resource allocation, manpower modeling, leadership techniques, and production methods				7	1	4.0
*Rank ranges from 1 to 10 with 1 = Highest Importance						

In terms of *knowledge*, persons in the featured computer positions should primarily possess *expertise in working with electric circuit boards, processors, chips, and computer hardware and software*. They all should also be well versed in *instructional methods and training techniques*. Not surprisingly, more knowledge is expected of programmers, systems analysts, computer engineers, and computer managers than of computer support specialists, especially in the areas of *mathematics* and the *English language*.

Additionally, computer engineers and managers have to be knowledgeable about *administrative and managerial processes* as well as *clerical procedures*. Programmers would be helped by knowing the latter, too. Those that have contact with clients, such as system analysts, engineers, and managers would also benefit in knowing about *customer and personal service*. Specifically, programmers should have a background in *communications and media*; computer engineers would need to know *engineering and technology, design, and telecommunications*; and computer managers should possess familiarity with *economics and accounting, personnel and human resources, and psychology*.

**Abilities Considered Important for Selected Computer Occupations**  
(Grouped by Frequency and Ranked by Order of Importance Within Each Group)

Abilities	Support Specialist	Programmer	Systems Analyst	Engineer	Manager	Rank Avg.*
<b>Written Comprehension</b> -The ability to read and understand information and ideas presented in writing	2	3	1	1	3	2.0
<b>Oral Comprehension</b> -The ability to listen to and understand information and ideas presented through spoken words and sentences	1	2	4	2	1	2.0
<b>Oral Expression</b> -The ability to communicate information and ideas in speaking so others will understand	3	1	7	4	2	3.4
<b>Written Expression</b> -The ability to read and understand information and ideas presented in writing	7	4	2	5	4	4.4
<b>Mathematical Reasoning</b> -The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem	8	6	3	6	6	5.8
<b>Deductive Reasoning</b> -The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense.	9	5	5	7	8	6.8
<b>Near Vision</b> -The ability to see details of objects at a close range (within a few feet of the observer)	6	7	6		9	7.0
<b>Problem Sensitivity</b> -The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.	4	10	9	9		8.0
<b>Inductive Reasoning</b> -The ability to combine separate pieces of information, or specific answers to problems, to form general rules or conclusions. It includes coming up with a logical explanation for why a series of seemingly unrelated events occur together.		9	10	3	10	8.0
<b>Speech Clarity</b> -The ability to speak clearly so that it is understandable to a listener	5			8	7	6.7
<b>Fluency of Ideas</b> -The ability to come up with a number of ideas about a given topic. It concerns the number of ideas produced and not the quality, correctness, or creativity of the ideas.	10	8	8			8.7
*Rank ranges from 1 to 10 with 1 = Highest						

**Abilities** are innate qualities that people bring to their work. Those that are useful to all of the above mentioned computer jobs are: *written and oral comprehension, written and oral expression, and mathematical and deductive reasoning*. As noted in the accompanying table, *near vision* or the ability to see details of objects at a close range, *problem sensitivity*, and *inductive reasoning* are also significant attributes for these positions to different extents. Additionally, *speech clarity* is vital for support specialists, engineers, and managers, while the *fluency of ideas*, which is the ability to come up with a number of ideas about a given topic, is necessary for support specialists, programmers, and systems analysts. Not shown but worthy to note, computer managers need to be *proficient with numbers* and computer engineers should be good at *information ordering*, which is the ability to correctly follow a given rule or set of rules in order to arrange things or actions in a certain order.